Diablo Canyon Power Plant

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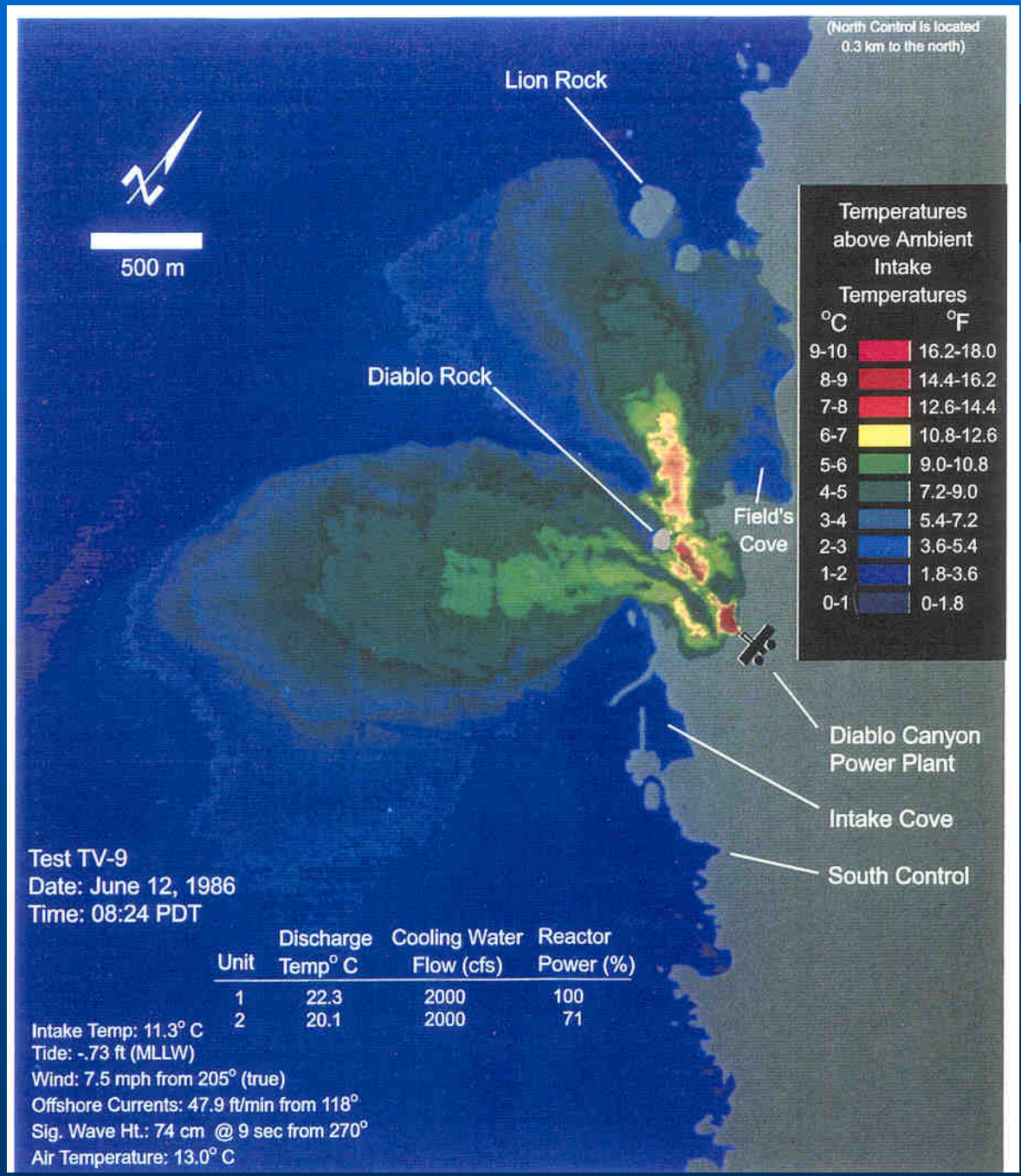
Diablo Canyon Power Plant


2.5 billion gallons per day
Thermal Discharge Effects in Diablo Cove

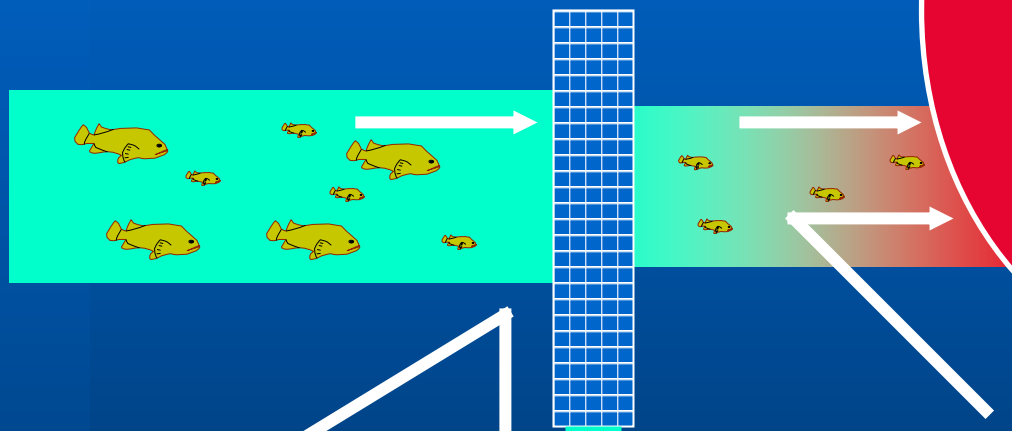

(North Control is located 0.3 km to the north)
Lion Rock
500 m
Temperatures above Ambient Intake Temperatures
°C °F
9-10 16.2-18.0
8-9 14.4-16.2
7-8 12.6-14.4
6-7 10.8-12.6
5-6 9.0-10.8
4-5 7.2-9.0
3-4 5.4-7.2
2-3 3.6-5.4
1-2 1.8-3.6
0-1 0-1.8
Diablo Rock
Field's Cove
Diablo Canyon Power Plant
Intake Cove
South Control
Test TV-9
Date: June 12, 1986
Time: 08:24 PDT
Unit | Discharge Temp° C | Cooling Water Flow (cfs) | Reactor Power (%)
1 | 22.3 | 2000 | 100
2 | 20.1 | 2000 | 71
Intake Temp: 11.3° C
Tide: -.73 ft (MLLW)
Wind: 7.5 mph from 205° (true)
Offshore Currents: 47.9 ft/min from 118°
Sig. Wave Ht.: 74 cm @ 9 sec from 270°
Air Temperature: 13.0° C

Entrainment and Impingement

22° F Warm water exits plant to open ocean

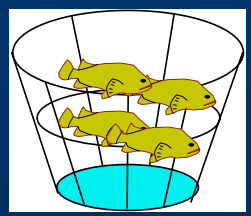
Power Plant

Fish (and Other organisms entrained in cooling system



Traveling screens impinge larger organisms

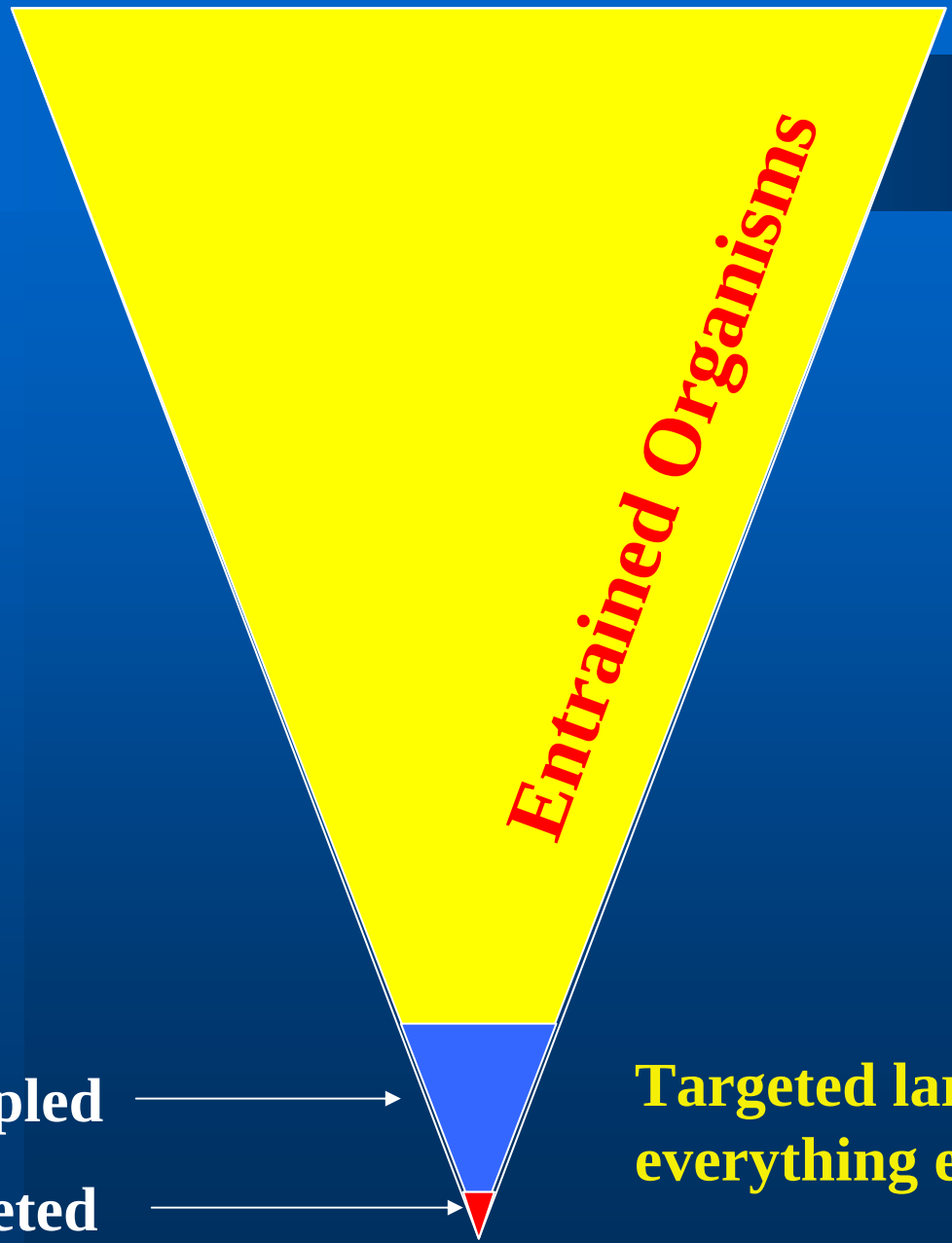
Smaller organisms (like larvae) entrained in system



Trash (fish and other organisms lost to impingement)

Five Very Difficult and Extraordinarily Contentious Issues

- Identifying and Quantifying species that are entrained (many are larval forms)
- Assessing the ecological impact
  - particularly the use and interpretation of models
- Converting impacts to a meaningful currency
- Evaluating technology options (screens, closed cooling) and costs
- Developing mitigation that accounts for direct and indirect impacts



Targeted larvae are a proxy for everything else

Converting Larval Losses to Meaningful Units of Measure

- **Habitat Production Foregone**
  - **How much habitat would it take to produce the larvae entrained?**
    - **210 to 500 acres of reef**
  - **Provides one possible indication of impact**
- **Other approaches:**
  - **Convert entrained larvae to adults**
    - **Adds up to a few thousand dollars per year**

Technology Evaluations

- Closed cooling
  - Fresh water towers
    - 50 million gallons per day
    - Not feasible
    - $billions +
  - Salt water towers
    - Can’t be permitted
    - Not feasible
    - $1.3 billion +
  - Dry cooling
    - Not physically possible
    - $3 billion +

Technology Evaluations…

- Fine Mesh Screens
  - Experimental
    - No evidence that they are better than once-through cooling (except wedgewire screens)
  - Never used at a facility like DCPP
  - $650 million to $1 billion

Mitigation

- Is it legal?
  - litigation underway
- Limited options
- Fish hatchery
  - Not applicable, usually addresses one species
- Artificial reefs
- Marine reserves

Status of Diablo Canyon Permit

- Review of mitigation options underway per Regional Board direction
  - September Board meeting
  - Record on technology already established
- Future requirements uncertain due to litigation (court decision ~ 1 year?)
- Note: State Board workshop on 316b issues scheduled for September 26 in Laguna Beach

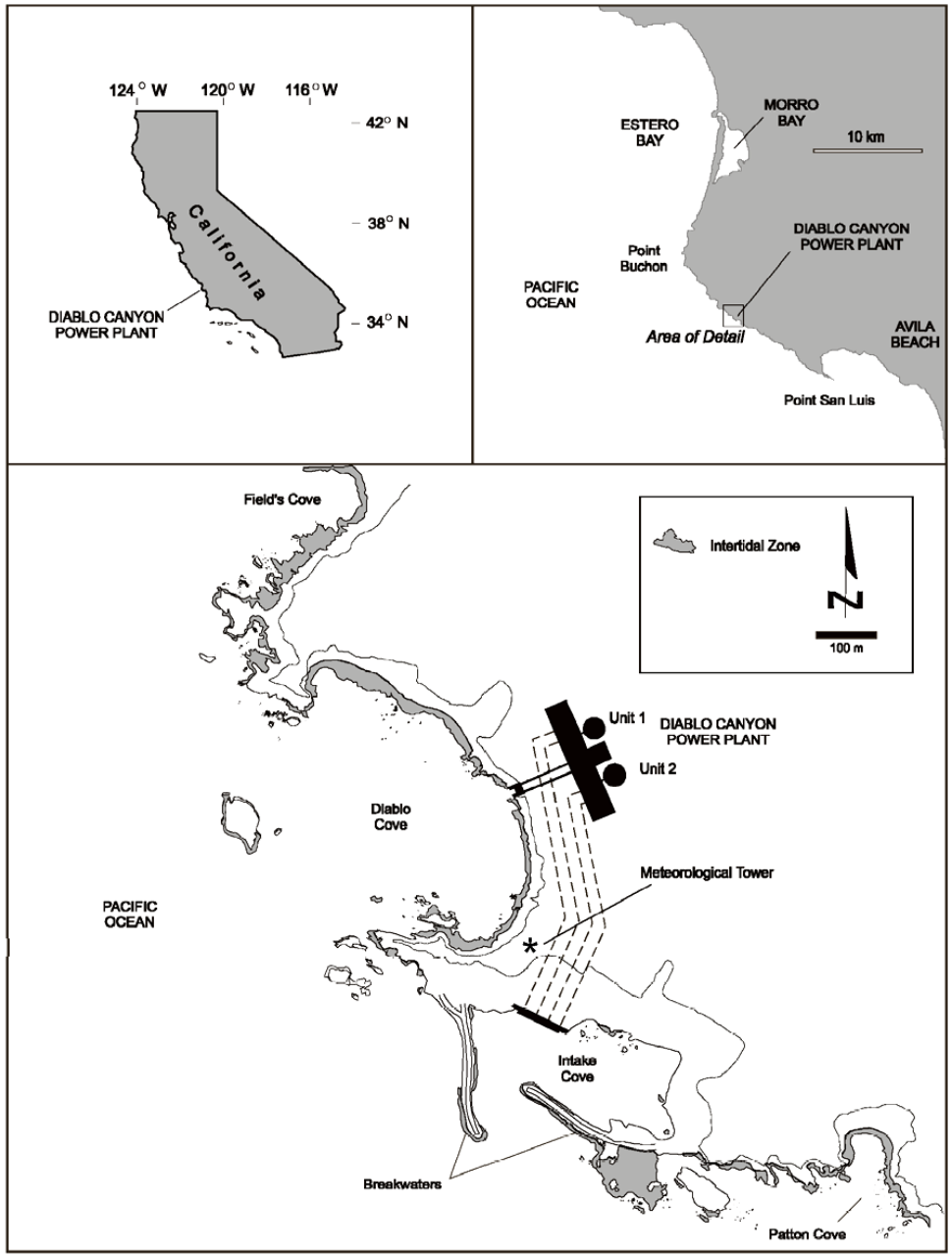
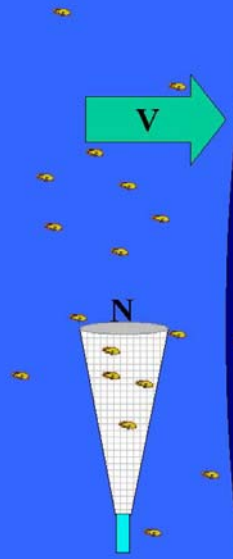


Figure 3-1. Location of Diablo Canyon Power Plant.

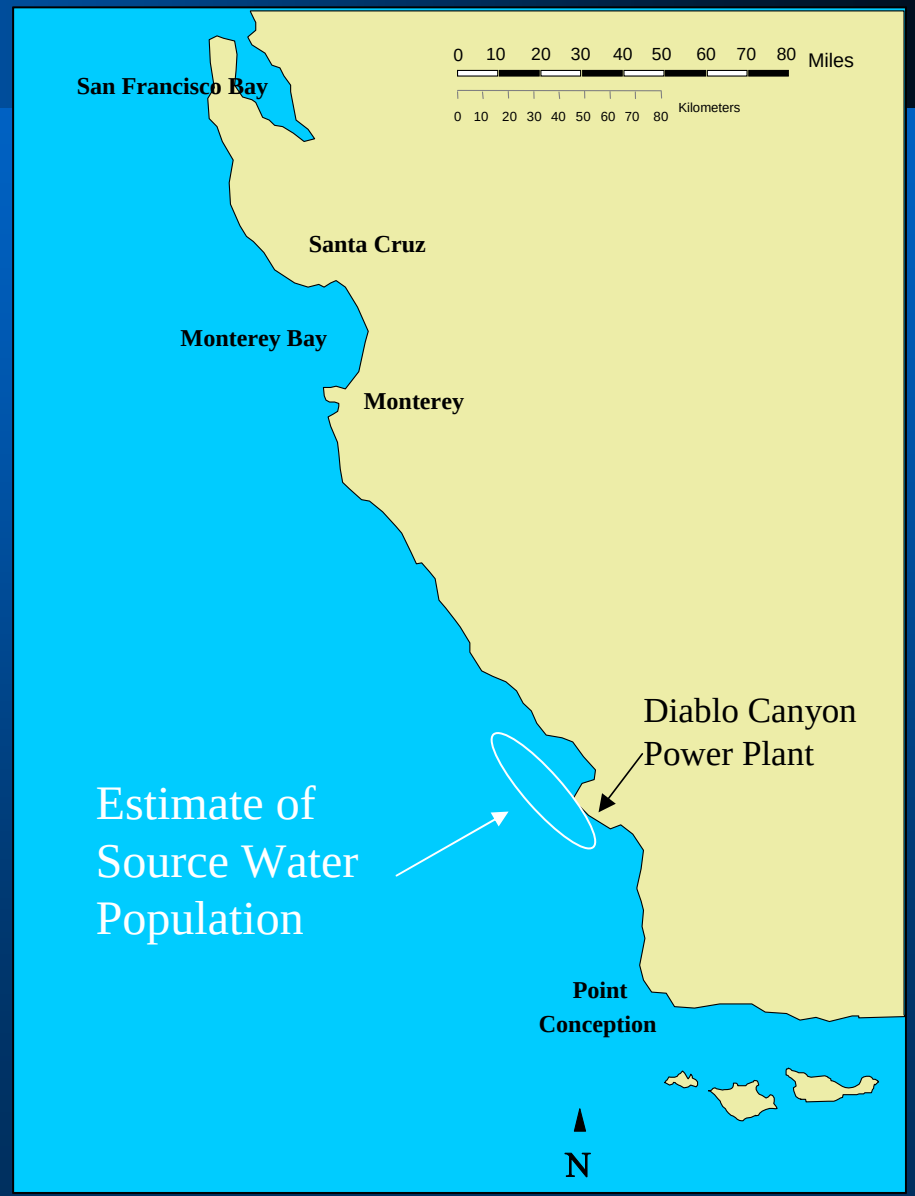
Estimation of larval losses due to entrainment



1. Calculate volume of cooling water entering the plant per year (V)
2. Measure concentration of larvae (number per volume) that are entrained (N)
3. *Assume no survival of larvae through the plant* – then
4. NV = the annual loss of larvae due to entrainment

The estimates of larvae entrained and the population at risk allow calculation of the Proportional Mortality (Pm) for a given species - **This represents the fraction of the population at risk that is lost to entrainment**

Estimation of Source Water Population



Estimation of Population at Risk
Step 1: Study Grid

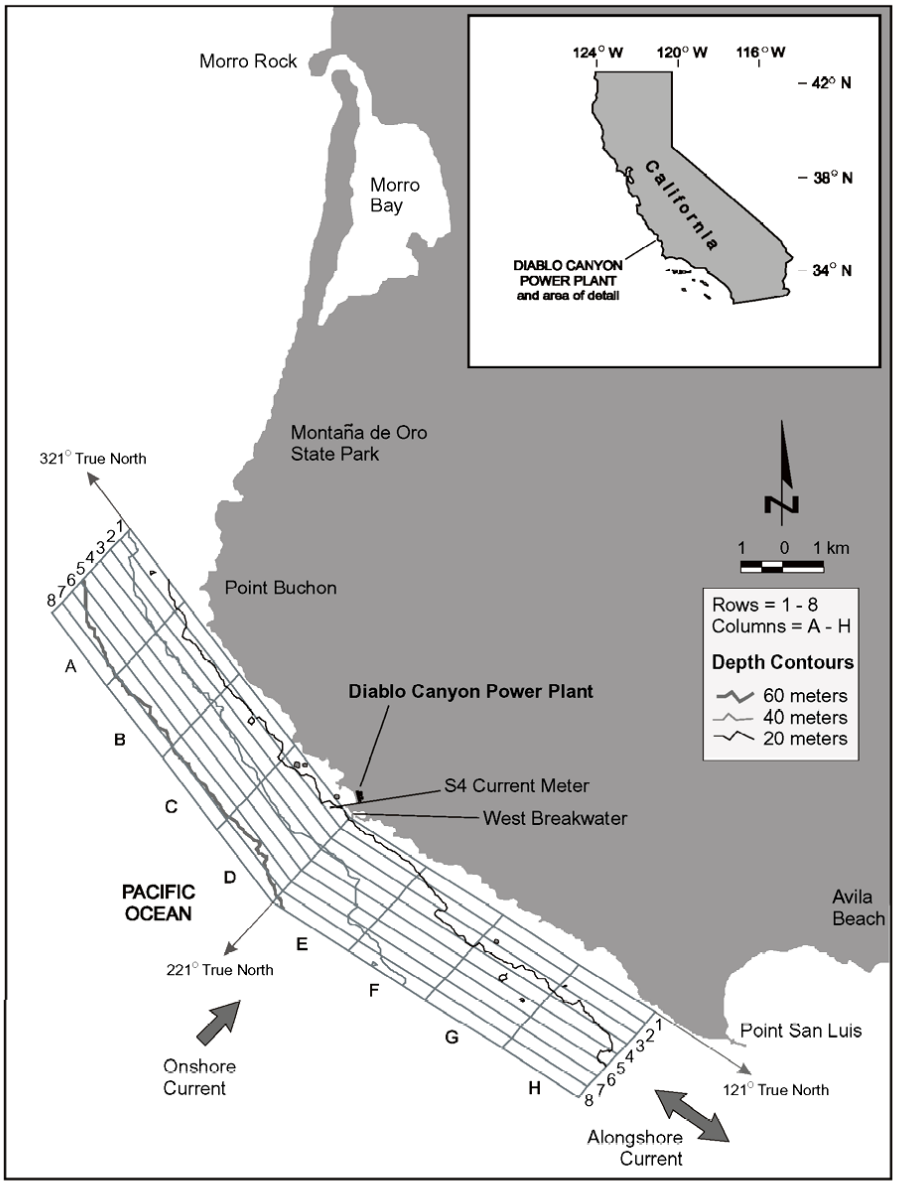
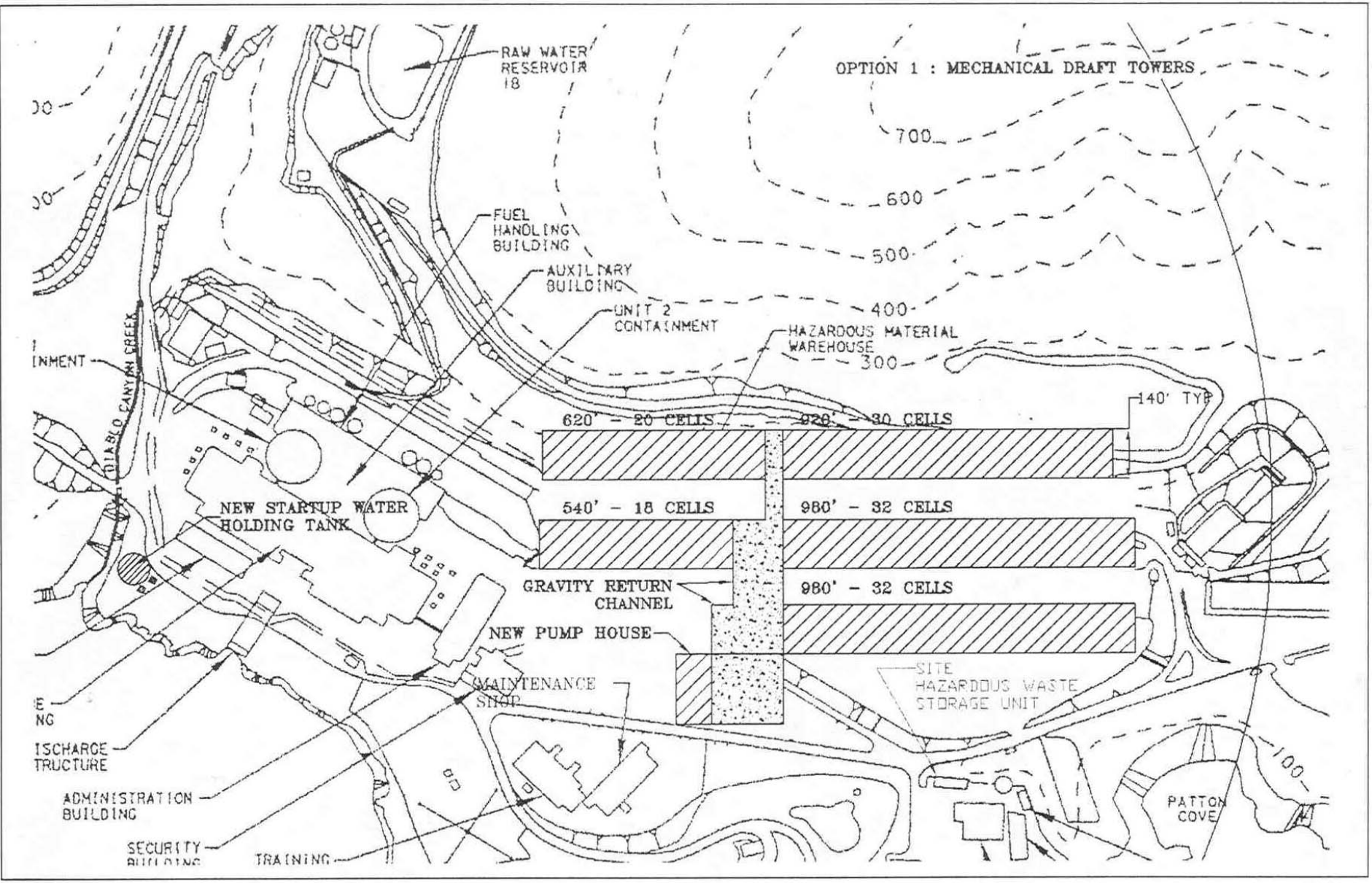


Figure 4-3. DCPP 316(b) study grid and depth contours.

H	G	F	E	D	C	B	A
8	8	8	8	8	8	8	8
7	7	7	7	7	7	7	7
6	6	6	6	6	6	6	6
5	5	5	5	5	5	5	5
4	4	4	4	4	4	4	4
3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1

DCPP Intake Cove

Figure 4-4. An example of the "ping-pong" sampling track employed in grid cell sampling; the starting cell (F1) and the initial southward direction of the transect were randomly selected. All 64 cells are sampled during the 72-hour survey period, weather permitting. DCPP' s Intake Cove is located east of the juncture between cells E1 and D1.

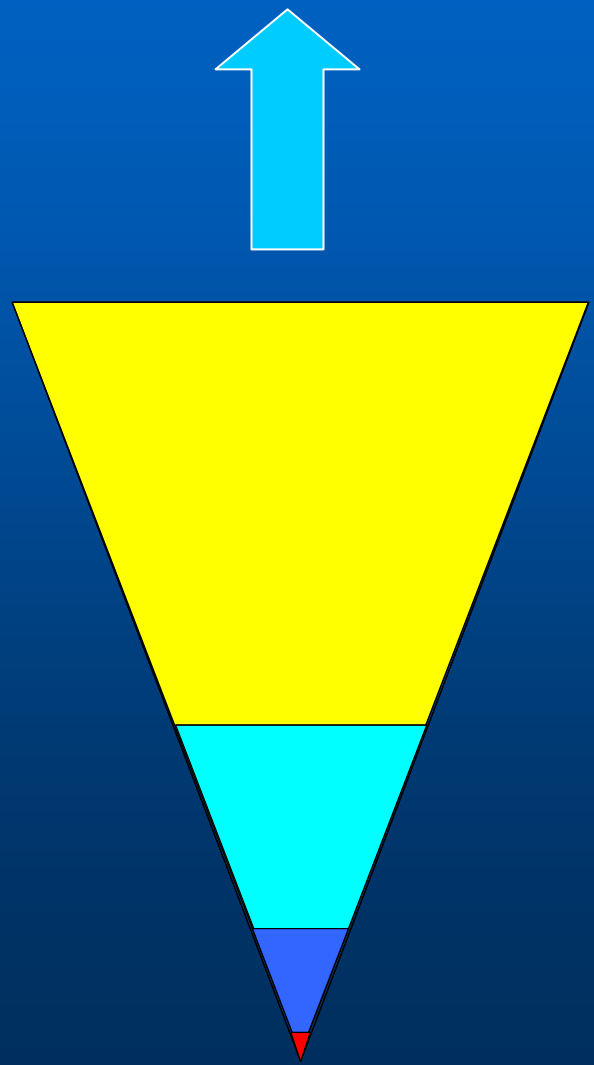

OPTION 1 : MECHANICAL DRAFT TOWERS
RAW WATER RESERVOIR 18
FUEL HANDLING BUILDING
AUXILIARY BUILDING
UNIT 2 CONTAINMENT
HAZARDOUS MATERIAL WAREHOUSE
700
600
500
400
300
100
140' TYP
620' - 20 CELLS
920' - 30 CELLS
540' - 18 CELLS
980' - 32 CELLS
980' - 32 CELLS
NEW STARTUP WATER HOLDING TANK
GRAVITY RETURN CHANNEL
NEW PUMP HOUSE
MAINTENANCE SHOP
SITE HAZARDOUS WASTE STORAGE UNIT
DIABLO CANYON CREEK
ADMINISTRATION BUILDING
SECURITY
TRAINING
PATTON COVE

Targeted Taxa

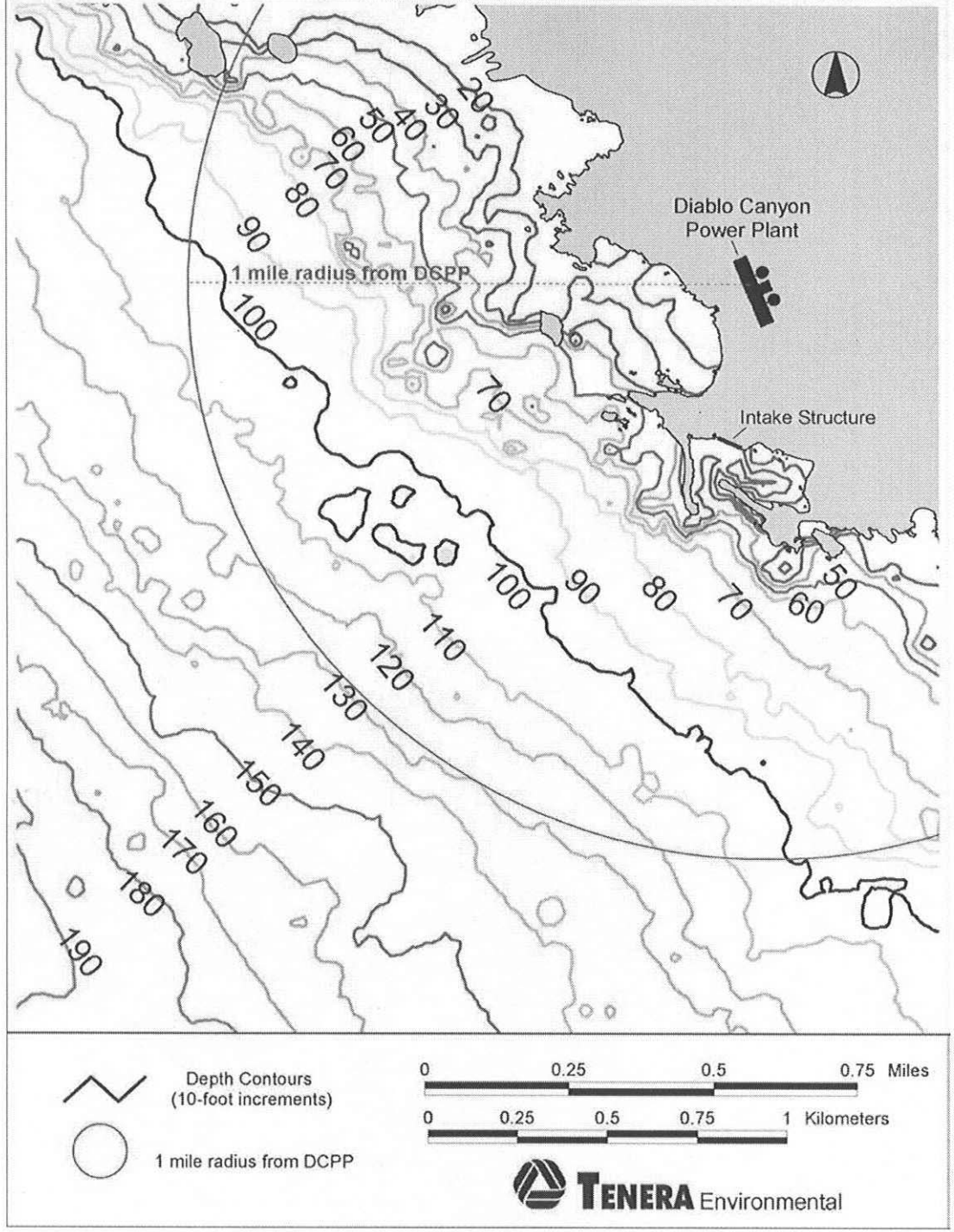
- **Nearshore Taxa**
  - Smoothhead sculpin
  - Monkey face prickleback
  - Clinid kelpfishes
- **Subtidal and Pelagic Taxa**
  - Painted greenling
  - Snubnose sculpin
  - Cabezon
  - Blackeye goby
  - Pacific sardine
  - Northern anchovy
  - White croaker
  - Blue rockfish
  - KGB rockfish
  - Sanddabs
  - California halibut
  - Brown rock crab
  - Slendercrab

Ecosystem effects – all the things that use planktonic organisms

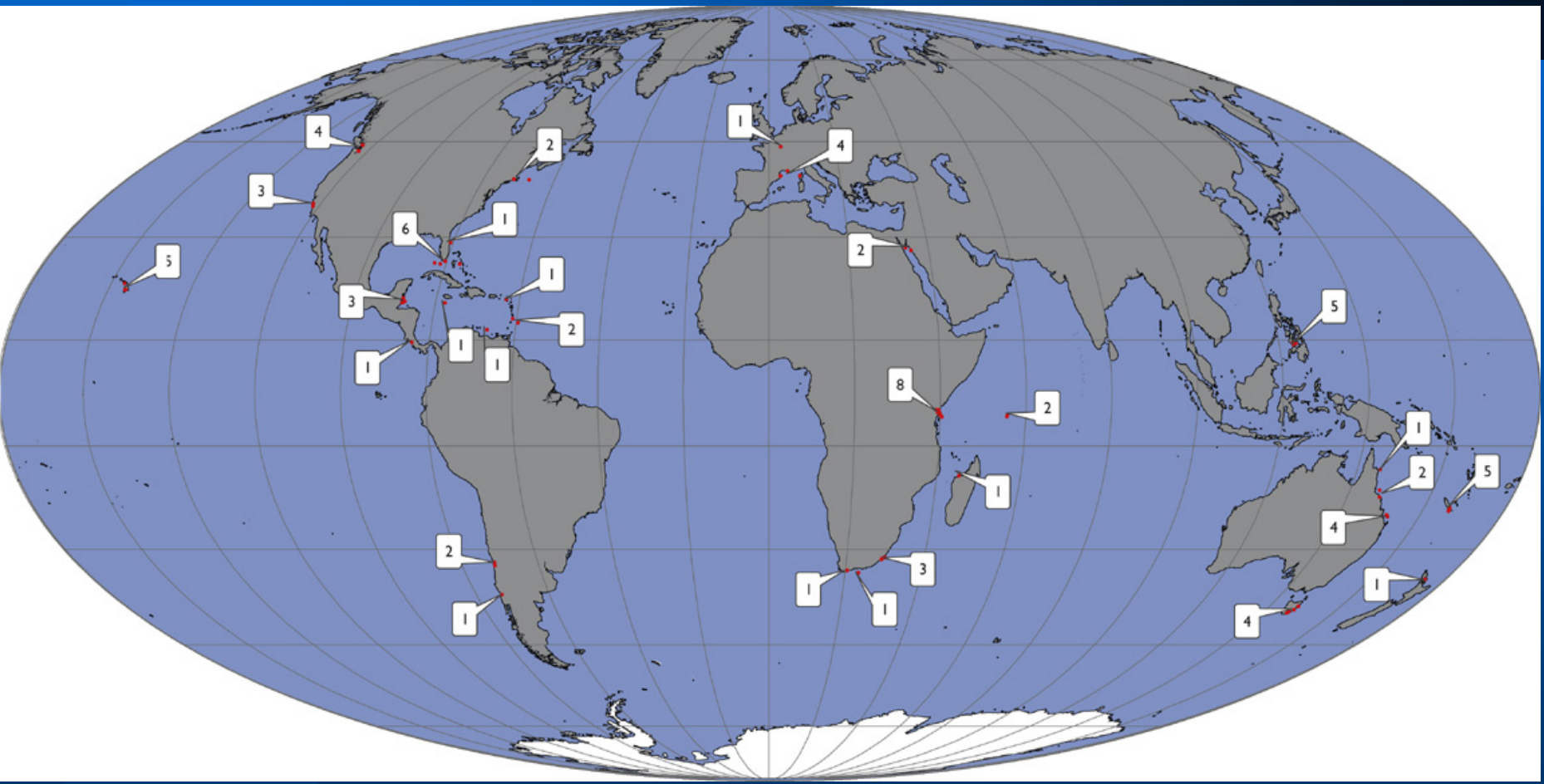
Completely Unstudied



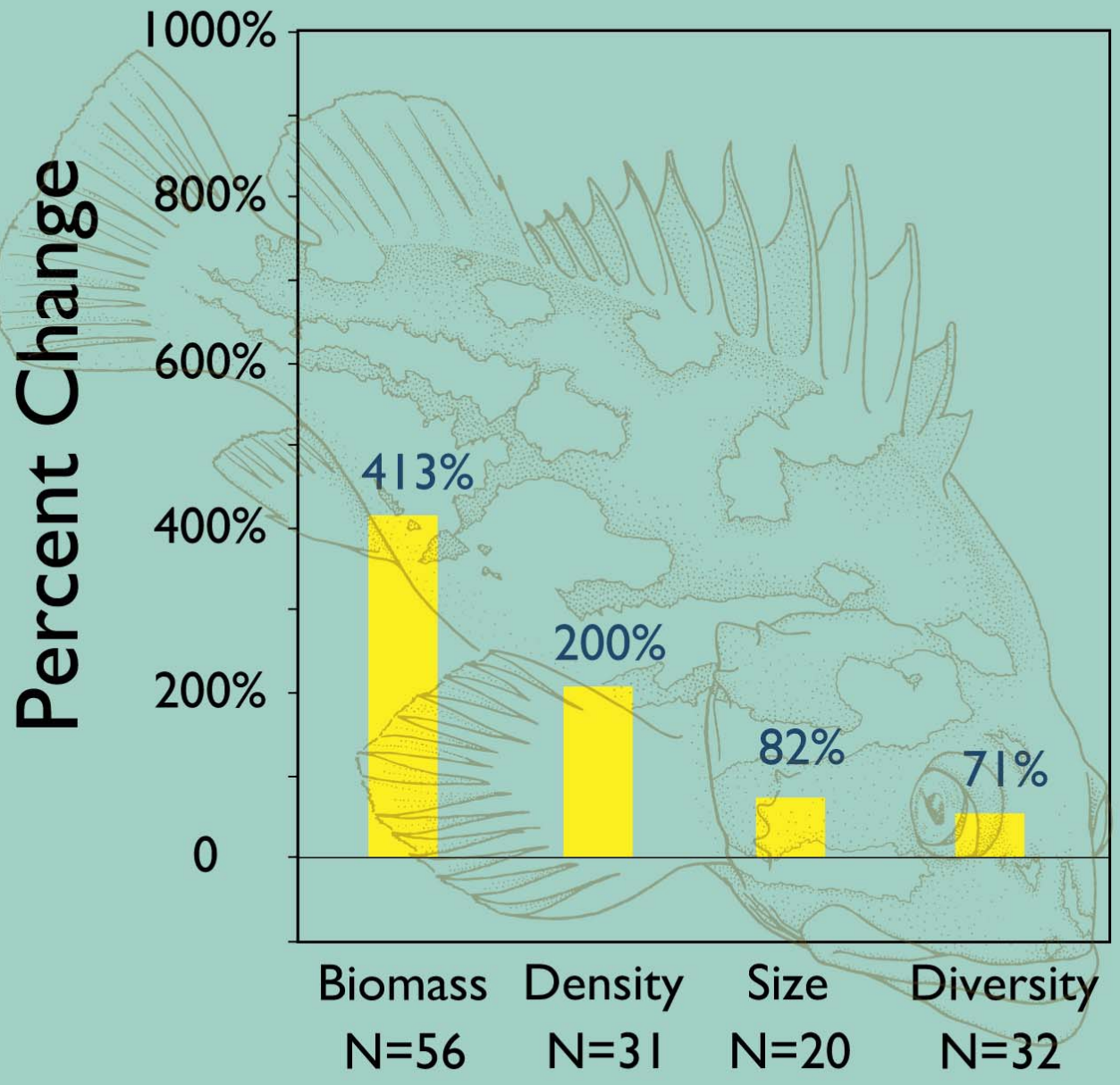
Bathymetry


Diablo Canyon
Power Plant
1 mile radius from DCPP
Intake Structure
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
Depth Contours
(10-foot increments)
1 mile radius from DCPP
0 0.25 0.5 0.75 Miles
0 0.25 0.5 0.75 1 Kilometers
TENERA Environmental

80 Marine Reserves with Peer Reviewed Scientific Studies

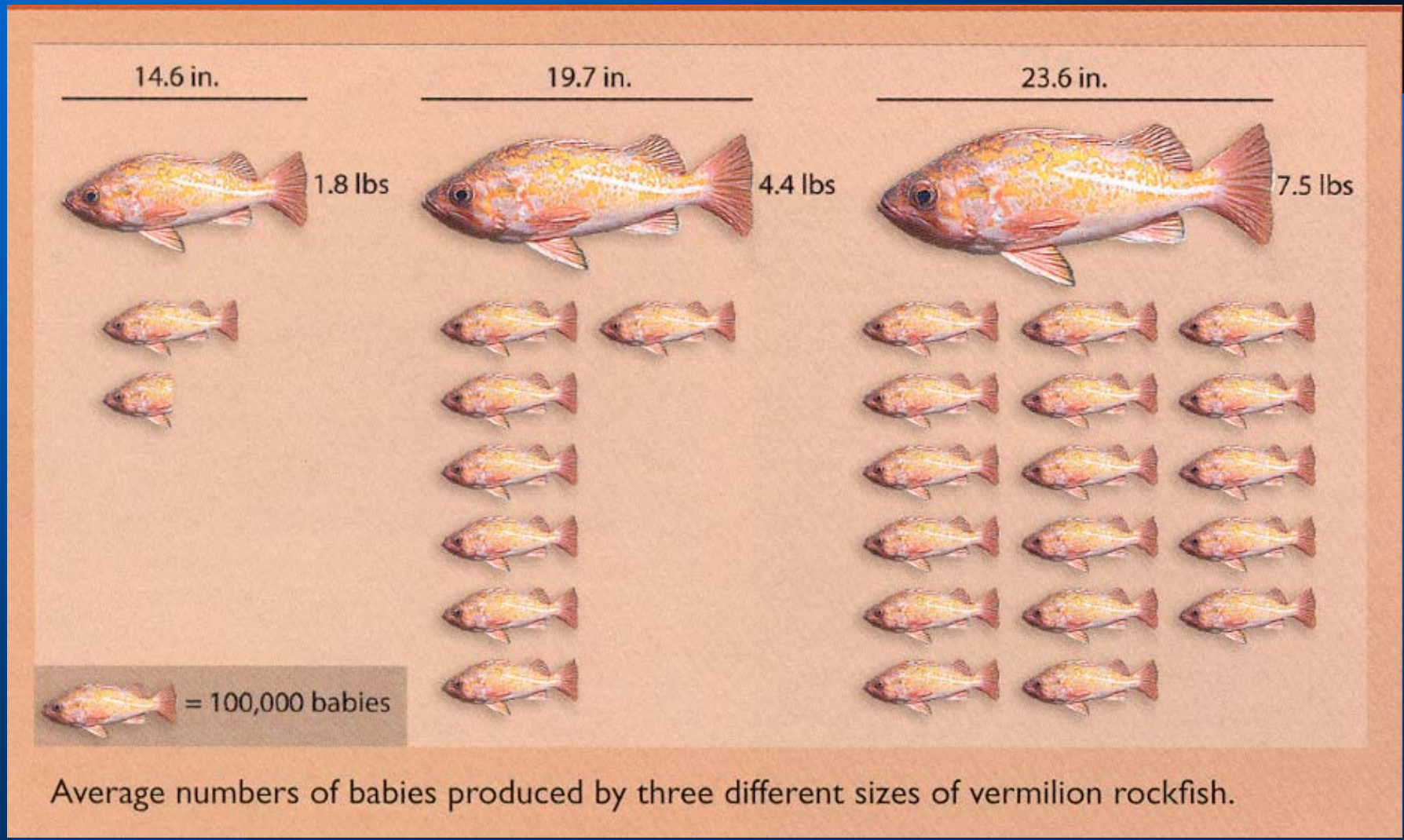


Range in size from less than 1 square mile to 400 square miles



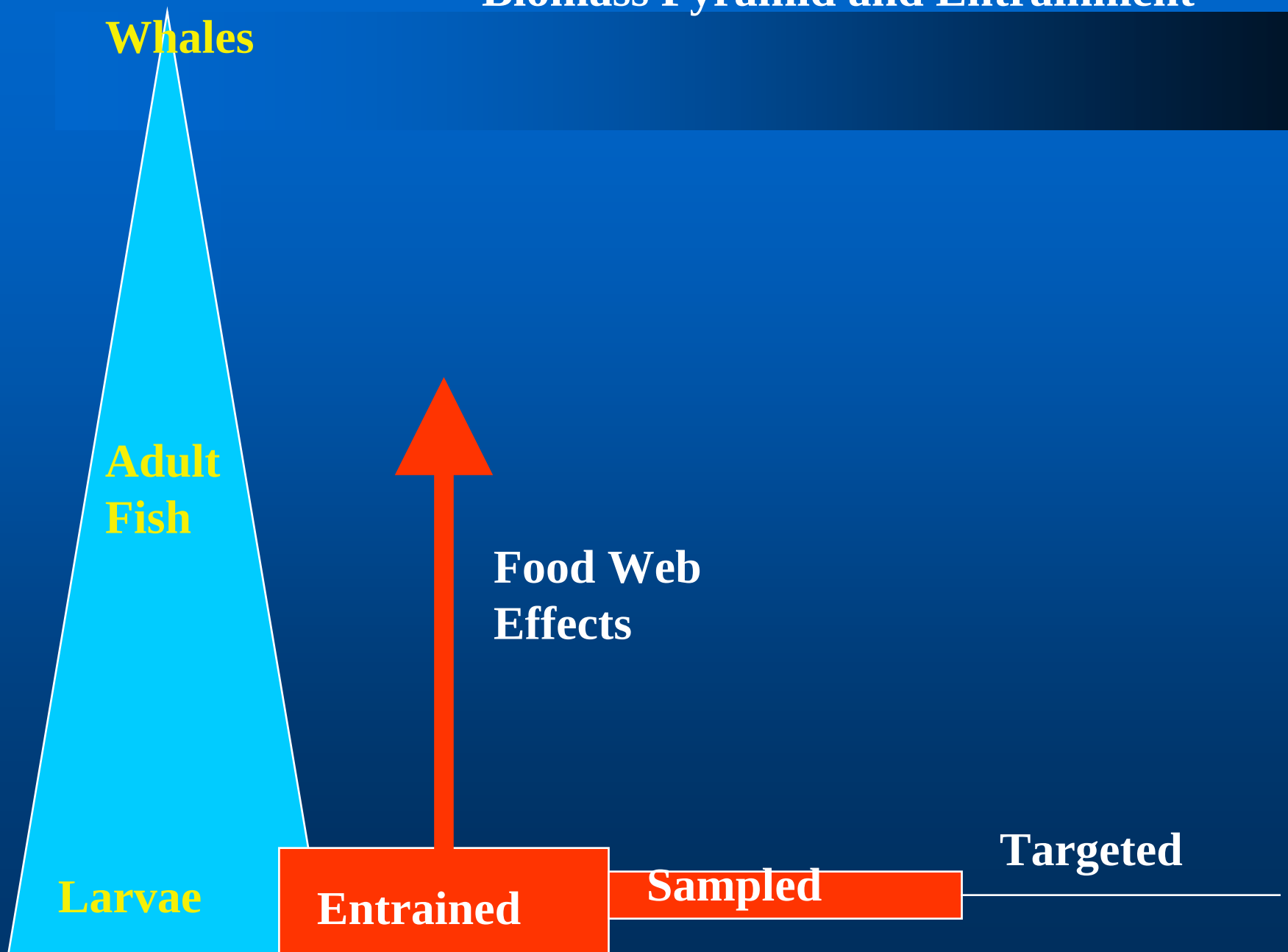
Large Effects Of Reserves Within Their Borders:

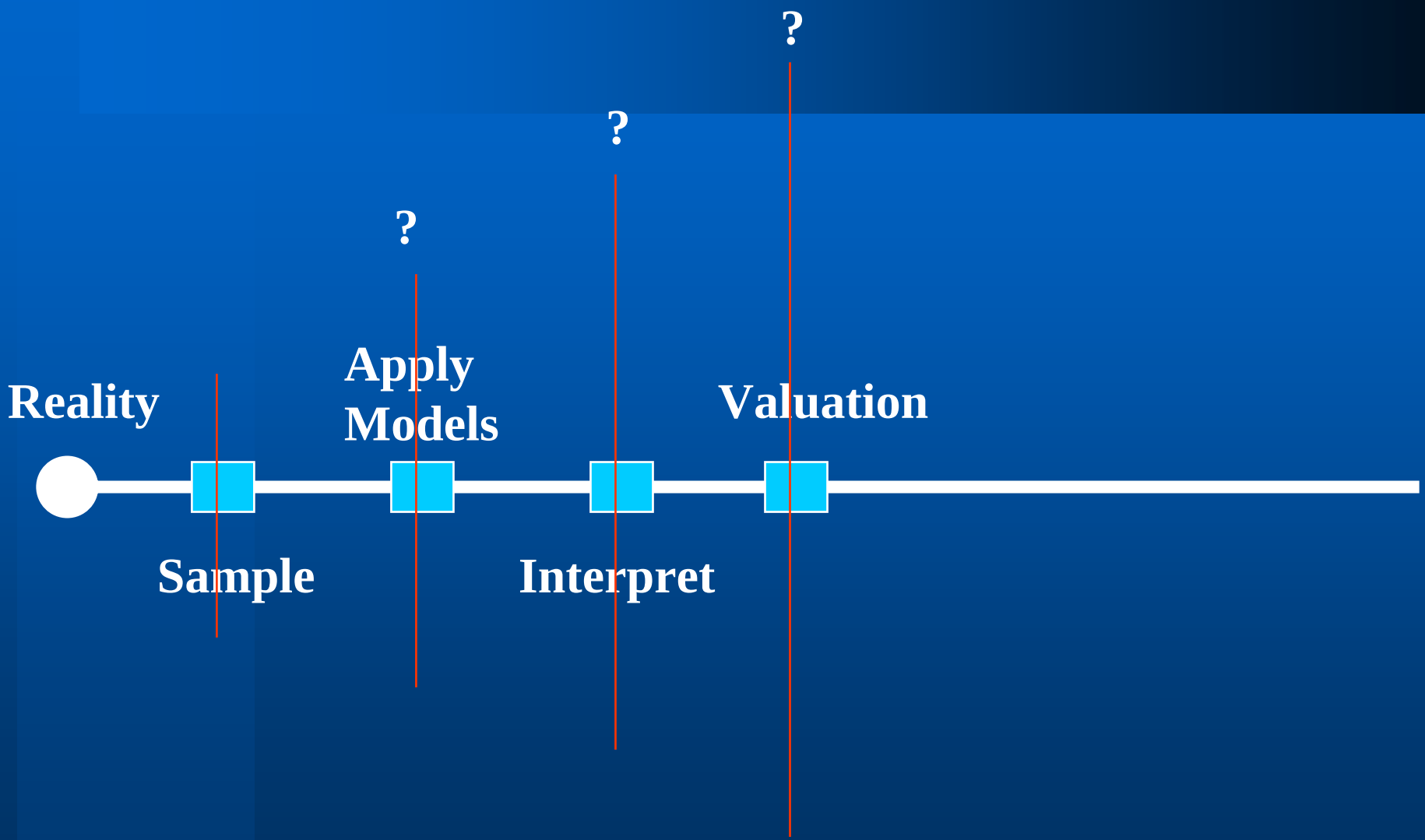
More biomass
More animals
Larger animals
More species



Average numbers of babies produced by three different sizes of vermilion rockfish.

Biomass Pyramid and Entrainment





Reality = Major declines in fish over very large areas

Solution = Marine reserves